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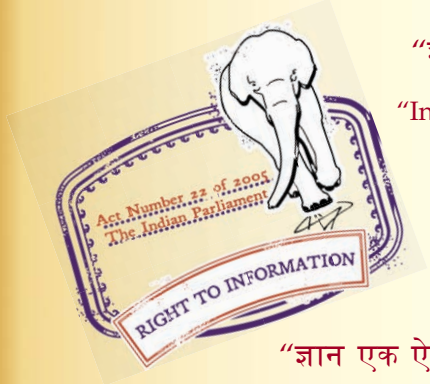
IS 10106-4-4 (1984): Packaging code, Part 4: Packages, Section 4: Glass containers [TED 24: Transport Packages]



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Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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IS : 10106 (Part 4/Sec 4) - 1984
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Indian Standard

PACKAGING CODE

PART 4 PACKAGES

Section 4 Glass Containers

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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 3

May 1984

Indian Standard

PACKAGING CODE

PART 4 PACKAGES

Section 4 Glass Containers

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Indian Standard

PACKAGING CODE

PART 4 PACKAGES

Section 4 Glass Containers

0. FOREWORD

0.1 This Indian Standard (Part 4/Sec 4) was adopted by the Indian Standards Institution on 31 January 1984, after the draft finalized by the Packaging Code Sectional Committee had been approved by the Marine, Cargo Movement and Packaging Division Council.

0.2 The packaging code is being issued in the following parts each having one or more sections:

Part 1 Product packaging
Part 2 Packaging materials
Part 3 Ancilliary materials
Part 4 Packages
Part 5 Packaging operations
Part 6 Storage and transportation
Part 7 Packaging machinery
Part 8 Testing

0.2.1 This section (Part 4/Sec 4) of the packaging code deals with glass containers.

0.3 Glass containers, manufactured in a great diversity of shapes and sizes, are an accepted packaging medium for almost every conceivable solid (granular or powered), semisolid or liquid product. The milk bottle, jam jar, beer bottle are familiar examples in every day life. They are also being widely used for pharmaceuticals, chemicals, perfumes, cosmetics, oils, detergents and many other household products. In this part various types of glass containers have been covered with a brief outline of their usage, technical specification with respect to their raw materials and composition and selection for various products.

0.4 In the preparation of this standard considerable assistance has been derived from BS 1133 : Section 18-1967 Packaging code, Glass containers issued by the British Standards Institution (BSI).

1. SCOPE

1.1 This standard (Part 4/Sec 4) gives guidance on the types of glass containers available for packaging purposes and describe factors for their selection.

2. TERMINOLOGY

2.1 For the purpose of this section of the code, the definitions given in IS : 6654-1982* shall apply.

3. INTRODUCTION

3.1 Glass can be defined as an inorganic product of fusion which is cooled to a rigid condition without crystallizing. The main raw materials for normal white flint container glasses, consist of high purity sand, limestone and soda ash usually mixed with a proportion of cullet to assist in the melting process.

3.2 With very few exceptions, glass is chemically inert. It has no inherent powers of action and hence it is compatible with almost all the products. It is impermeable and non-porous and combines with these properties the important qualities of clarity, transparency and ease of cleaning. The mechanical strength and thermal resistance of glass containers permit their use on high speed filling and sterilizing plant. Glass is also readily produced in a number of colours which are of intrinsic appeal and may also protect sensitive products against harmful light rays.

4. TYPES OF GLASS CONTAINERS

4.1 The range of types, sizes and shapes of glass containers is extremely wide. For general purpose, they may be conveniently classified into three main types according to size and method of manufacture : tubular glass containers including ampoules and vials, glass bottles and jars as such, and large containers such as carboys.

4.2 Tubular Glass Containers

4.2.1 As the name indicates, these are made from glass tubing. They are therefore all cylindrical in shape. With some exceptions the dimensions of tubular glass containers vary between 5 to 35 mm in diameter, and 20 to 200 mm in length and the capacity may vary between 0·5 to 100 ml. Depending on the purpose for which the container is required, it may be manufactured from soda glass or neutral glass tubing. Tubular glass containers may be divided into three main groups.

4.2.2 *Straight Sided Tubes* — Suitable for all products where it is important that the opening does not restrict the passage of the contents, for

*Glossary of terms relating to glass containers (*first revision*).

example, tablets or powders. Closures used in this type of tube are usually cork, plastics or rubber.

4.2.3 *Vials* — Suitable for a wide variety of products where a small capacity container is required. Most neck finishes, including sprinkler, are available. Cork, rubber, plastics and metal threaded and snap-on closures are in general use [*see* IS : 1984 (Part 1)-1971*].

4.2.4 *Ampoules* — Made from neutral or soda glass tubing of two main types, that is, narrow stem for liquids and wide stem for powders. The stems are sealed in or drawn off by the application of gas burners. [For more detail *see* IS : 489 (Part 1)-1973† and IS : 489 (Part 2)-1973‡].

4.3 Glass Bottles and Jars

4.3.1 Types of glass containers are usually defined by reference to their size, capacity and neck finish. The 'finish' depends on the closure selected for the container (*see* **5.2**). These glass containers may be broadly divided into three classes, that is, sprinkler top, narrow and wide mouthed — the latter two corresponding roughly with the descriptions of 'bottles' and 'jars'. Various cross-sectional shapes lead to corresponding description, for example, rounds, ovals, triangulars, hexagons, squares, flats and panels. The term 'flask' as applied to commercial containers is associated with a narrow mouthed container and roughly rectangular or oval cross section, commonly used for spirits.

4.3.2 Indian Standards covering glass bottles and jars are listed in Appendix A.

4.4 Carboys — As glass has a high chemical resistance, it is popular for packing variety of chemicals which otherwise attack many other packaging materials. For this purpose glass carboys have been developed. Glass carboys may be either cylindrical or pear-shaped. Large narrow neck glass containers are available in nominal capacities of 15 to 60 litres. Glass carboys are generally made of colourless or pale green glass.

5. NECK FINISHES AND CLOSURES

5.1 Neck Finishes — Neck finish is the most important feature in description of glass containers. Depending upon the product to be packed, its processing and dispensing, suitable neck finish is selected. A variety of neck finishes are now being produced by the glass container industry. Most of these are suitable for high speed filling and capping operations.

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*Glass vials for pharmaceutical preparations: Part 1 Vials for parenteral preparations (*first revision*).

†Glass ampoules: Part 1 Ampoules for liquid injectables (*second revision*).

‡Glass ampoules: Part 2 Ampoules for lyophilized injectables (*second revision*).

A summary sheet of different types of threaded and non-threaded neck finishes has been given in IS : 7511-1974*. They are described below.

5.1.1 *Continuous Thread Glass Finishes* — Suitable for pre-threaded closures for capping operation on non-automatic filling lines. Depending upon the neck size, the neck finishes are chosen as:

a) shallow continuous thread finishes, and

b) tall continuous thread finishes.

NOTE — For detailed dimensions *see* Tables 1 and 2 of IS : 7511-1974*.

5.1.2 *Roll Seal (RS) Finishes* — Suitable for capping operations on automatic filling and capping lines. Depending upon the pilfer-proof requirement of the product, the neck finish is further classified as:

a) pilfer-proof (RSPP), and

b) nonpilfer-proof (RSNP).

NOTE — For detailed dimensions *see* Tables 3 and 4 of IS : 7511-1974*.

5.1.2.1 Pilfer-proof means, a seal that cannot be opened without partially destroying the cap or, otherwise, showing evidence of tampering.

5.1.3 *Non-threaded Glass Finish*

5.1.3.1 *Crown cork (cap) finish* — These types of containers can retain the extremely high internal pressure developed when carbonate drinks or other gaseous drinks are contained in the bottle (*see* Table 5 of IS : 7511-1974*).

5.1.3.2 *Vial goldie seal finish* — A neck finish to suit cork, metal, rubber or plastic stoppers or plastic caps. This is specifically meant for injectibles (*see* Table 6 of IS : 7511-1974* *and* IS : 2123-1977†).

5.1.3.3 *Dual glass finish* — This is a combination of crown cork finish with screw cap finish (*see* Table 7 of IS : 7511-1974*). This is suitable for food preserves like sauces and ketchups.

5.2 Closures

5.2.1 Closures are of many and varied types. They form an essential part of an efficient pack in conjunction with glass containers. Closures are manufactured in a wide range of materials and can be produced in any desired size and with the necessary precision to ensure, upon correct application, the effective sealing of the glass containers after filling. Closures are made for sealing solids (powders), liquids, creams, pastes,

*Summary sheet on glass containers neck finishes.

†Specification for vial (goldie) seals (*first revision*).

hygroscopic materials, detergents, bleaches, beverages (soft carbonated or alcoholic), pharmaceuticals, cosmetics, etc, and if necessary, they can be designed to withstand pasteurization and sterilization process. Closures other than corks have almost always to be fitted with liners wad to make a good seal, but certain thermoplastic closures can sometimes be used without liners wad. The closure itself may incorporate features for dispensing and measuring the product and improving the pouring characteristic of the container. In addition, where required, closures may be composed of material which are specific, for example non-toxic, odour free or non-bleaching.

5.2.2 *Metal Closures* — Tinplate or aluminium sheets are the main basic materials used. Laquering and decorating of tinplate or aluminium sheets is carried out prior to fabricating the closure and this too gives partial protection against corrosion as well as ease of formation of closure. Tinplate is used for closures of the more robust type, and which are fully formed before application to the container, although there are exceptions to the latter rule; the most notable exception being the familiar crown cork (cap). Aluminium can be drawn or formed to various shapes with comparative ease as metal screw corresponding to the various neck finishes. (For details *see* IS : 1994-1971*, IS : 2123-1977†, IS : 8393-1977‡ and IS : 8932-1978§.)

5.2.3 *Plastics Closures* — Plastics closures can be moulded in a wide range of shapes and sizes strong enough to make a good seal on glass containers. They are light in weight and can be produced in any colour; opaque, translucent or transparent. These can be divided into two basic types: thermosetting and thermoplastic. Thermoplastic materials with their range and grades are suitable for screw threaded and plug type closures, whereas the thermosetting materials are generally used for screw threaded applications only.

6. DESIGN

6.1 The design should firstly be economic to produce, acceptable to the packer and convenient to use by the consumer. It shall withstand warehousing and transportation without undue breakage.

6.2 Strength

6.2.1 For any given glass weight, a spherical shaped container is theoretically the strongest. Giving a container of round cross section an index of 10 (half of the strength of a spherical shape) the strength of an

*Specification for crown closures.
†Specification for vials (goldie) seals (*first revision*).
‡Specification for roll seal pilfer-proof closures.
§Specification for preformed metal screw caps for glass containers.

elliptical cross section container can be expressed as 5 and that of a square with well rounded corners as 2·5 although these shapes would be of adequate strength in general use. Sharp corners and shoulders should be avoided. Bottle to bottle contact should be minimized.

6.2.2 Resistance to thermal shock is improved by thinner walls and uniform distribution of glass.

6.3 Weight — The lightweight containers have proved stronger in use than their heavier predecessors, breakages have been reduced and savings achieved in handling and freight costs. The closer the design approaches the natural shape of blown glass, the sphere, the greater the saving in weight of glass.

6.4 Stability — During handling, glass containers should be capable of being conveyed without toppling. This should be taken into consideration in design, for instance, by a low centre of gravity and a flat base.

6.5 Specifications — Some external dimensions are invariably important, for example, body diameter and height and tolerances shall be negotiated between the glass container manufacturer, machinery manufacturer and the packer according to the size and shape of the container. Capacity tolerance is specially important. The dimensional relationships of bottles for carbonated products and non-carbonated products is laid down in IS : 10133-1982*.

6.6 Appearance — Within the design considerations mentioned above there is extreme diversity in shape and design available to glass container users, and in most cases the best functional designs are also acceptable from the point of view of their appearance. It must be taken into account how the glass container will display at retail level and handle in the home. Special designs are an obvious way of achieving individuality. Individuality can also be readily achieved by different labelling and surface decoration, colour of glass and variety of closure. Rough surfaces and irregular contours may increase difficulty particularly in labelling, washing and sterilizing bottles.

6.7 Colour — By the addition of suitable materials to the batch mix glass may be produced in a very wide range of colours and certain products are traditionally linked with glass container made in particular shades, for example, beer in amber bottle.

Some important colours are:

a) *Amber* — Usually obtained by adding various amounts of carbon and sulphur or iron and manganese oxide. The shade ranges from a light yellow to a deep reddish brown.

*Specification for glass bottles — Dimensional relationships and tolerances.

b) *Blue* — Made by adding cobalt oxide or less commonly copper oxide to produce glasses of various hues.

c) *Green* — Obtained by varying additions of iron, manganese and chromium oxide.

d) *Opal* — An opaque or milky glass which is usually white but can be coloured; made by the addition of fluorides and alumina.

e) *Ruby* — Usually made by adding selenium and cadmium sulphide.

7. QUALITY CONTROL AND TESTING

7.1 Routine tests are carried out at regular intervals by glass container manufacturers during production, to ensure that all the necessary measurable properties of the container are maintained at the appropriate standard. Testing will normally be carried out at regular fixed intervals, but on occasions the frequency of testing may be increased, for example, in the early stages of a production run. The method of sampling in these cases is invariably to take complete 'rounds' of containers, that is, one or more from every mould, or, if the moulds have multiple cavities, from every cavity of the machine.

7.1.1 To ensure the randomness of selection the procedure given in IS : 4905-1968* may be followed and to determine the sample size and acceptance number of defective samples, the sampling tables given in IS : 2500 (Part I)-1973† may be referred to.

7.1.2 In a few cases, the object of a user's tests may be to determine the average value of one of the measured characteristics of a consignment of containers, rather than to use the test for acceptance purposes. In this case it might be better for the user to make tests on 'rounds' of containers selected from the consignment rather than to use random samples. This, however, depends on the nature of the property concerned, and is a matter which should be discussed with the manufacturer.

7.1.3 Regardless of the reasons for the testing, the principles involved in the tests will be exactly the same for each of the three cases discussed. There may be small differences in details of technique, for example, between one manufacturer and another, but all the methods in current use are usually capable of producing reproducible and useful results. The principles involved in the main types of tests are discussed below. Details of testing will be given in Part 8 of this code.

7.2 Dimensions — The most important dimensions of glass containers are usually the dimensions and exact form of the container's neck and

*Methods of random sampling.

†Sampling inspection tables: Part 1 Inspection by attributes and by count of defects (*first revision*).

finish, the overall height and the body diameter or similar cross-sectional dimensions. All these may readily be checked by means of go/no-go gauges, vernier caliper, vernier height gauge or any other suitable instrument.

7.3 Condition of Annealing — The annealing of containers is checked regularly by manufacturers by means of a polariscope or strain viewer, in which any strain in a transparent article appears as a characteristic colour in an otherwise uniform field of coloured illumination. A quantitative assessment of annealing is normally carried out by comparison in the strain viewer of the glass container under test with standard glass strain discs. The detailed method is given in IS : 9153-1978.*

7.4 Internal Pressure Strength — For any container which has to withstand internal pressure in service, it is important that the 'bursting pressure' should be sufficient to provide an adequate safety margin. The detailed methods of test are given in IS : 10516-1983†.

7.5 Thermal Shock Tests — The term thermal shock is used to refer to the strain produced if a temperature difference is suddenly established between the inner and outer walls of a container, for more details *see* IS : 6506-1972‡.

7.6 Capacity — It is convenient to test container capacities by means of a 'bulk test', in which the aggregate capacity is determined directly on a sample of several bottles. The number of bottles in the sample may depend on several factors but is usually within the range 12 to 24 inclusive. Due consideration should also be given to any legislative requirements relating to filled containers.

7.6.1 Containers may be tested for capacity, either brimful, that is, the condition in which the container is filled with water so that the centre of the liquid meniscus is level with the rim of the neck of the container, or alternatively if it is essential to know the capacity when the container is filled to a certain height, the test can be carried out accordingly, using a suitable depth gauge or extractor gauge to adjust the height. The total capacity of the sample may be determined by weight, by subtracting the empty weights from the filled weights, or by a volumetric method in which the filled bottles are emptied into a graduated measure. For details *see* IS : 10497-1983§.

7.6.2 Capacity control is achieved by variation in bottle weight. It should not, therefore, be assumed that glass weights are constant.

*Methods of polariscopic examination of glasswares.
†Methods of test for internal pressure resistance of glass containers.
‡Methods for thermal shock tests on glassware.
§Method of test for the determination of brimful capacity of glass containers by gravimetric method.

7.7 Limit for Alkalinity Test — For this test *see* IS : 2303-1963*.

8. FILLING OF GLASS CONTAINERS

8.1 When glass containers are filled with liquids, it is most important to have the correct vacuity, that is, free expansion space above the liquid and below the closure. It is essential that the correct vacuity is determined for each separate product to be sealed.

9. PACKING OF GLASS CONTAINERS

9.1 Fibreboard cases are increasingly used for consignments of filled glass containers. Wooden crates are used in some instances. For details *see* IS : 6945-1973†.

10. LABELLING

10.0 Labels may be readily applied to a container either in printed form, usually at the time when the container is filled and capped or by enamelling or vitreous enamel decoration, a process carried out by the glass containers manufacturer.

10.1 Labels are generally glued before applying to the bottles. Labels are also available backed with a composition which is softened by heat before application. The latter dispenses with gluing mechanisms, but requires instead a heating mechanism. These labels cannot be so readily removed from the returned bottles. Pressure sensitive labels are also available.

10.1.1 Design of label must be considered in relation to the glass container, type of labelling machine to be employed, and subsequent usage. Some of the factors to be considered are included in the following:

a) The surface to which the label is to be applied should be smooth and flat, or curved in a single direction.

b) Sudden changes in curvature of surface should be avoided, since label edges are liable to lift away and machine application is rendered more difficult or impossible.

c) For machine labelling, particularly at high speeds, labels should be positioned so that they can be effectively ' wiped ' to ensure a smooth fit.

d) Dimensional accuracy of labels is very important for machine labelling, to ensure proper extraction from the label magazine and good registration on the bottle.

*Method of grading glass for alkalinity.
†Code of practice for packaging glass and glassware.

e) Due allowance must be made for changes of dimension. Wet labels shrink as they dry whereas heat seal labels tend to expand with moisture pick-up from the air. Convex surfaces will give rise to least trouble from these effects.

f) To preserve the appearance of the labels, they should be positioned where they are not liable to be scuffed in handling. A slight recess on the container is very useful from this point of view, though it calls for correct registration of the bottle in the labelling machine.

10.1.2 For satisfactory results, it is highly desirable that the container manufacturer and the labelling machine manufacturer be consulted before the type, size and disposition of labels is finally decided.

APPENDIX A

(*Clause* 4.3.2)

INDIAN STANDARDS RELATED TO GLASS CONTAINERS

IS : 1106-1957	Distilled water glass bottles
IS : 1107-1974	Aerated water glass bottles, crown cork type (*first revision*)
IS : 1108-1975	Pharmaceutical glass containers (*second revision*)
IS : 1392-1971	Glass milk bottles (*second revision*)
IS : 1494-1971	Glass containers for preserved fruits industry and domestic fruit preserves (*first revision*)
IS : 1662-1974	Glass liquor bottles (*second revision*)
IS : 1945-1961	Glass bottles for fluid inks
IS : 2091-1983	Multi-trip glass beer bottles (*second revision*)
IS : 2351-1963	Marble stoppered aerated water glass bottles
IS : 6654-1982	Glossary of terms relating to glass containers (*first revision*)
IS : 6954-1973	Code of safety for caustic potash (*Reaffirmed* 1979)
IS : 7511-1974	Summary sheet on glass containers neck finishes

IS : 8697-1977 Code of practice for export packaging of glass container ware

IS : 9780-1981 Glass bottles for tomato ketchup

IS : 9781-1981 Glass jars for jam, jellies and marmalades

IS : 10133-1982 Glass bottles dimensional relationship and tolerances

IS : 10497-1983 Methods of test for determination of brimful capacity of glass containers by gravimetric method

IS : 10516-1983 Methods of test for internal pressure resistance test for glass containers